



April 1, 2022

The Honorable Kimberly D. Bose  
Secretary  
Federal Energy Regulatory Commission  
888 First Street, NE  
Washington, D.C. 20426

## **INFORMATIONAL FILING-NO NOTICE REQUIRED**

**Re: California Independent System Operator Corporation  
Informational Readiness Certification for the Tucson Electric Power's  
Participation in the WEIM  
Docket No. ER15-861-000**

Dear Secretary Bose:

The California Independent System Operator Corporation (CAISO) submits this informational filing in compliance with section 29.2(b)(6) of the CAISO tariff.<sup>1</sup> The CAISO, in consultation with the Tucson Electric Power (TEP), has determined that, following market simulation and an adequate period of parallel operations, the CAISO and TEP have met all readiness criteria specified in section 29.2(b)(7). In support of this determination the CAISO hereby submits the sworn CAISO affidavit of Khaled Abdul-Rahman, Vice President of Power System and Market Technology, and the sworn TEP affidavit of Erik Bakken, Vice President of Systems Operations and Energy Resources. This filing certifies the readiness of the CAISO and TEP to proceed with TEP's participation in the CAISO's Western Energy Imbalance Market (WEIM) on May 3, 2022, consistent with the requirement to do so at least 30 days prior.

### **I. Background**

The WEIM provides other balancing authority areas the opportunity to participate in the real-time market for imbalance energy that the CAISO operates

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<sup>1</sup> The Commission has determined that readiness certifications are considered informational filings and will not be noticed for comment. See *Cal. Indep. Sys. Operator Corp.*, 153 FERC ¶ 61,205 at P 86 and n.173 (2015); see also *Cal. Indep. Sys. Operator Corp.*, 155 FERC ¶ 61,283 at P 8 (2016).

in its own balancing authority area. The CAISO's WEIM tariff provisions went into effect on October 24, 2014, in time for the first trading day of November 1, 2014.<sup>2</sup> In a March 16, 2015 order,<sup>3</sup> the Commission concluded that certain readiness safeguards are necessary prior to activating a prospective EIM Entity in production.<sup>4</sup> Accordingly, the Commission directed the CAISO to include provisions in its tariff to ensure the readiness of any new EIM Entity. The Commission further required that the certification of market readiness include a sworn affidavit from an officer of the CAISO and an officer of the prospective EIM Entity attesting that both have prepared and made ready the systems and processes for the new EIM Entity to commence financially binding participation in the WEIM.<sup>5</sup> Following two compliance filings, the Commission accepted the CAISO's proposed readiness criteria.<sup>6</sup> These criteria appear in section 29.2(b)(7) of the CAISO Tariff.

## II. Readiness Reporting, Determination, and Attestations

The CAISO and TEP ran market simulation scenarios from December 1, 2021 to February 15, 2022. Parallel (*i.e.*, financially nonbinding) operations began on February 16, 2022 and ran with TEP through at least April 1, 2022. The parallel operation environment will continue to be available to TEP until May 3, 2022, at which point the CAISO and TEP expect that production operation will begin.<sup>7</sup>

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<sup>2</sup> See *Cal. Indep. Sys. Operator Corp.*, 147 FERC ¶ 61,231 (2014) (June 19 Order) (conditionally accepting tariff revisions to implement Energy Imbalance Market); *Cal. Indep. Sys. Operator Corp.*, 149 FERC ¶ 61,058 (2014) (order denying requests for rehearing, granting in part and denying in part requests for clarification, and conditionally accepting tariff revisions on compliance with regard to order listed above); Commission Letter Order, 149 FERC ¶ 61,005 (Oct. 2, 2014) (order granting CAISO request to extend effective date of Energy Imbalance Market tariff revisions from September 23, 2014, to October 24, 2014, for trading day November 1, 2014).

<sup>3</sup> *Cal. Indep. Sys. Operator Corp.*, 150 FERC ¶ 61,191 (2015) (March 16 Order).

<sup>4</sup> March 16 Order at P 30.

<sup>5</sup> *Id.* n.85.

<sup>6</sup> *Cal. Indep. Sys. Operator Corp.*, 153 FERC ¶ 61,205 (2015).

<sup>7</sup> TEP implementation is also supported by the JOU Pilot Agreement, which was accepted by the Commission effective December 22, 2021. *Cal. Indep. Sys. Operator Corp.*, 177 FERC ¶ 61,214 (2021). Subsequently, the CAISO, PNM and TEP amended the JOU Pilot Agreement to address a few issues identified during implementation, which was filed with the Commission for acceptance effective May 3, 2022 and is pending in Docket No. ER22-1394.

During market simulation and parallel operations the CAISO and TEP have engaged in regular discussions to track progress and confirm the status of each readiness criterion, and the CAISO has regularly reported on readiness status in market forum discussions and publicly posted a table or “dashboard,” showing progress towards meeting the readiness criteria.<sup>8</sup> The process of updating the readiness dashboard through this joint effort involved representatives from both organizations, including senior representatives involved in the process leading to attestation that the parties’ processes and systems are ready for TEP’s participation in the WEIM.

The market simulation confirmed system functionality and connectivity by identifying issues and software variances in advance of implementation that have since been resolved. In addition, market simulation permitted the CAISO and TEP to validate performance of the systems and processes under a variety of structured scenarios. The market simulation dashboard dated February 11, 2022 demonstrated that the CAISO and TEP were ready to enter parallel operations. Having achieved the benefits from market simulation, the CAISO and TEP transitioned to parallel operations on February 16, 2022.

The parallel operations phase is designed to test performance of the systems and processes in a financially non-binding environment using historical data and information from production systems to the maximum extent possible. The CAISO and TEP have engaged in parallel operations to examine capabilities at different times and conditions (morning ramp, evening ramp, low load and peak load). Doing so has permitted TEP to understand the interaction between resource plans, base schedules, outage management, manual dispatch, and the CAISO full network model. This period has also allowed the CAISO and TEP to identify and resolve software issues. The dashboards dated March 4, 2022 and March 21, 2022 track the progress during parallel operations as additional readiness criteria were met. The most recent dashboard, dated March 25, 2022, is included as Attachment A.

The dashboard sets forth each of the readiness criteria in the tariff, the metrics by which the CAISO measures satisfaction of the criteria, and the actions or status that demonstrate TEP’s compliance with criteria. The dashboard shows that all readiness criteria have been satisfied or will be satisfied by May 3, 2022. In any event, Section 29(b)(6) requires that a senior officer of the CAISO and a prospective EIM Entity attest: (1) that the processes and systems of the prospective EIM Entity have satisfied or will have satisfied the readiness criteria set forth in section 29.2(b)(7) as of the Implementation Date; (2) to any known

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<sup>8</sup> More information on the status of these other reports consistent with CAISO tariff section 29.2(b)(8) is available on the CAISO website under the Spring 2022 release, Western EIM Tucson Electric Power entities at:

<https://www.caiso.com/informed/Pages/ReleasePlanning/Default.aspx>.

issues requiring resolution prior to the Implementation Date in accordance with section 29.2(b)(8); (3) to any exceptions from the established thresholds specified in the Business Practice Manuals, and that despite such exceptions the criteria were met or will be met as specified in 29.2(b)(7); and (4) that the Implementation Date is conditional on the resolution of the known issues identified in the certificates and any unforeseen issues that undermine the satisfaction of the readiness criteria. Attachments B and C, respectively, contain the sworn CAISO affidavit of Khaled Abdul-Rahman, Vice President of Power System and Market Technology and the sworn TEP affidavit of Erik Bakken, Vice President of Systems Operations and Energy Resources in satisfaction of this requirement.

The affidavits are based upon the engagement by these senior officers in assessing the readiness criteria as reported in the dashboard, including supporting documentation. The CAISO believes that the market simulation and parallel operations to date demonstrate that TEP is prepared to enter financially binding production WEIM operations on May 3, 2022, as explained above.

### **III. Market Quality Report on Parallel Operations**

Parallel operations allowed the CAISO and TEP to identify and resolve numerous input, process, and software issues prior to the commencement of financially binding operations.<sup>9</sup> The CAISO and TEP worked diligently during parallel operations to identify the cause of the infeasibilities that arose. The attached Market Quality Report demonstrates that the majority of the power balance infeasibilities identified during the period of parallel operations associated with the readiness determination were caused by input data issues, some of which are unique to the parallel operations environment and software issues, all of which have been or will be resolved by the implementation date.

The CAISO validated both prices and schedules based on the data input to the market systems for 28 days of parallel operations. This validation demonstrates that the market solution produced is as expected and consistent with the market rules as designed based on the input data. The analysis conducted for the report accounts for the fact that input data may be influenced by limitations inherent in the parallel operations environment and these limitations may affect the quality of the solution. When factors affecting the input data are controlled for, the numerical quality of the market solution is good and

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<sup>9</sup> The market quality report on parallel operations dated March 25, 2022 explains how each of these issues impacted the market results and how they were resolved by the CAISO and TEP.

indicates that the systems and processes of TEP are ready to operate in production.

#### **IV. Attachments**

Attachment A: Readiness Dashboard Report  
Attachment B: Affidavit of Khaled Abdul-Rahman  
Attachment C: Affidavit of Erik Bakken  
Attachment D: Parallel Operations Market Quality Report

#### **V. Conclusion**

The CAISO respectfully requests that the Commission accept this certification as consistent with section 29.2(b)(6) of the CAISO tariff. The CAISO or TEP will notify the Commission in the event of any subsequent determination that the implementation of TEP into the WEIM on May 3, 2022 should be delayed, the reason for the delay, the new implementation date if it can be determined, and whether a portion or all of this certification needs to be reissued.

Respectfully submitted,

**By: /s/ John C. Anders**  
John C. Anders

Roger E. Collanton  
General Counsel  
Burton A. Gross  
Deputy General Counsel  
John C. Anders  
Assistant General Counsel  
California Independent  
System Operator Corporation  
250 Outcropping Way  
Folsom, CA 95630  
Tel: (916) 608-7287  
[janders@caiso.com](mailto:janders@caiso.com)

Counsel for the California Independent System Operator Corporation

**Attachment A – Readiness Dashboard Report**

**Informational Readiness Certification for**

**Tucson Electric Power's**

**Participation in the Energy Imbalance Market**

**California Independent Systems Operator Corporation**

**April 1, 2022**

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
1	Prospective WEIM Entity Full Network Model Integration	Generation, Interchange and Load comparison	Load, WEIM Internal Intertie and WEIM External Interties, and Generating Unit definition in the Full Network Model is consistent with the Load, WEIM Internal Intertie and WEIM External Interties, and Generating Unit definition in the exported prospective WEIM Entity network model file that it delivered to the CAISO.	Data matches within 10%, measured in MW capacity to start parallel operation, and within 5% before full activation. Any Discrepancies are accounted for in terms of imbalance adjustment	CAISO	Complete		Tariff section 29.2(b)(7)(A)(i)
2	Prospective WEIM Entity Full Network Model Integration	Comparison of SCADA measurement	SCADA measurements used in prospective WEIM Entity EMS model match the measurements observed by the CAISO through the CAISO EMS model	Critical and used SCADA measurements match 90% to start parallel operation and 95% before full activation, measured in MW, outside of any exception in EMS model	CAISO	Complete		Tariff section 29.2(b)(7)(A)(ii)
3	Prospective WEIM Entity Full Network Model Integration	State Estimator solution	CAISO state estimator solution is equivalent or superior to the prospective WEIM Entity state estimator solution for its Balancing Authority Area.	State Estimator solutions converge >90% of the time in two days before parallel operation and three days before full activation. Solution differences within 10% before parallel operation and 5% before full activation measured in MW or justified due to different external BAA modeling	CAISO	Complete		Tariff section 29.2(b)(7)(A)(ii)
4	Prospective WEIM Entity Full Network Model Integration	Non-Conforming Load, Behind-the-Meter Generation, Pseudo Ties, and Dynamic Schedules	Physical representation of the prospective WEIM Entity's network matches the Base Market Model that accounts for non-conforming load, behind-the-meter generation, pseudo-ties, and dynamic schedules, and third party transmission service provider and path operator information that supports WEIM Transfers and Real-Time Dispatch in the Energy Imbalance Market, as applicable	Prospective WEIM Entity major non-conforming loads > 5% of prospective WEIM Entity total actual load in MW are modeled separately from conforming load in market model	CAISO	Complete		Tariff section 29.2(b)(7)(A)(iv)
5	Agreements	Execution of Necessary Agreements	The prospective WEIM Entity has executed all necessary agreements.	The prospective WEIM Entity will execute all agreements, as outlined in Section 5 of the WEIM BPM within the required timelines outlined in Section 5.	JOINT	Complete		Tariff section 29.2(b)(7)(K)(i)

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
6	Operations Training	Completion of mandatory training courses	Prospective WEIM Entity operators who will have responsibility for WEIM operations, transactions and settlements, will complete CAISO training modules.	Prospective WEIM Entity operators will Complete training and close-of-training assessment in the appropriate timeframes as outlined in “100 series”– an introduction to Energy Imbalance Market training “200 series”– the specific hourly and daily tasks and duties for normal operation training module; and “300 series”– the assessment of market results and response to contingencies and abnormal situations training module.	TEP	Complete		Tariff section 29.2(b)(7)(B)
7	Forecasting Capability	Load forecast capability	Definition of WEIM demand forecast boundaries based on the conforming and non-conforming load characteristics, as applicable. <ul style="list-style-type: none"> <li>Accuracy of the CAISO forecast of WEIM demand based on historical actual load data for the defined WEIM demand forecast boundaries.</li> <li>Identification of weather station(s) locations used in forecasting, if applicable.</li> </ul>	All Plant Information (PI) tags and historical data for defined load area(s), and non-conforming load, if applicable, compared with load forecasts provided from CAISO (if CAISO load forecast used).	CAISO	Complete		Tariff sections 29.2(b)(7)(C)(i)-(iii)
8	Forecasting Capability	Variable Energy Resource (VER) forecast capability	Identification of the source of VER forecasts. (If a participating wind or solar unit requires a CAISO forecast, then BPM and Tariff requirements apply.)	Forecasting entity must demonstrate delivery of Unit MW forecast at 5 min intervals for at least three hours ahead. Forecasting entity must also provide base schedule by T-75, T-55 and T-40. WEIM Entity provides to CAISO real-time MW production PI tags.	CAISO	Complete		Tariff section 29.2(b)(7)(C)(iv)
9	Forecasting Capability	Flexible capacity requirements	CAISO has established flexible capacity requirements for the prospective WEIM Entity Balancing Authority Area and the combined WEIM Area including the prospective WEIM Entity	The CAISO has received and stored all historical data from the prospective WEIM Entity necessary and sufficient for the CAISO to perform the flexible ramp requirement.	CAISO	Complete		Tariff section 29.2(b)(7)(K)(iv)



Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
10	Balanced Schedules	Base schedule balancing capability	The prospective WEIM Entity Scheduling Coordinator demonstrates its ability to balance WEIM demand and WEIM supply for the prospective WEIM Entity's Balancing Authority Area	90% or greater of base schedules balance tests during monitored hours are within 10% average imbalance of load forecast over one day period before parallel operation, and 5% average over five full days before full activation. The CAISO will provide examples of MW thresholds for each prospective WEIM Entity to indicate a reasonable threshold as it applies to a given WEIM Entity and indicate the potential implications of a swing from 5% over to 5% under forecast in one hour to the next.	TEP	Complete		Tariff section 29.2(b)(7)(D)(i)
11	Balanced Schedules	Flexible ramping sufficiency test capability	The prospective WEIM Entity \ Scheduling Coordinator demonstrates its ability to pass the flexible ramping sufficiency test.	Passes 90% of the time or greater over monitored hours of one day before parallel operation and five non-consecutive days before full activation.	TEP	Complete		Tariff section 29.2(b)(7)(D)(ii)
12	Balanced Schedules	Capacity test capability	The prospective WEIM Entity Scheduling Coordinator demonstrates its ability to pass capacity test	Passes 90% of the time or greater over monitored hours of one day before parallel operation and five non-consecutive days before full activation. The CAISO will explain the implications of any potential issues with the reliability of an WEIM Entity to meet its capacity requirements.	CAISO	Complete		Tariff section 29.2(b)(7)(D)(ii)
13	Operating Procedures	CAISO operating procedures (relevant to WEIM operations)	The prospective WEIM Entity signs CAISO non-disclosure agreement and receives appropriate CAISO "public" and "restricted" operating procedures	Operating procedures NDA signed by the prospective WEIM Entity. The prospective WEIM Entity receives CAISO operating procedures four months prior to the parallel operations date.	JOINT	Complete		Tariff section 29.2(b)(7)(K)(i)
14	Operating Procedures	Prospective WEIM Entity operating procedures	The prospective WEIM Entity operating procedures are defined, updated, and tested for the WEIM Entity Scheduling Coordinator	The prospective WEIM Entity operating procedures are updated tested and implemented prior to parallel operations date.	TEP	Complete		Tariff section 29.2(b)(7)(K)(ii)
15	System Readiness & Integration	Functional Testing	The prospective WEIM Entity and the CAISO will test the functional and system elements in accordance with functional and system testing documentation posted on the CAISO website	All tasks identified in the functional and system testing documentation are complete and will not have any issues deemed significant. Any exceptions will be explained or have an interim solution that is functionally equivalent.	TEP	Complete		Tariff section 29.2(b)(7)(E)(i)
16	System Readiness & Integration	System Integration	The prospective WEIM Entity and CAISO will test system integration testing in accordance with the system integration testing documentation posted on the CAISO website	All tasks identified in the system integration testing documentation are complete and will not have any issues deemed significant. Any exceptions will be explained or have an interim solution that is functionally equivalent.	TEP	Complete		Tariff section 29.2(b)(7)(E)(ii)

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
17	System Readiness & Integration	The prospective WEIM Entity system access complete	All prospective WEIM Entity employees who require system access to perform WEIM -related job functions identified and have necessary certificates.	All prospective WEIM Employees performing job functions for WEIM market are identified. All CAISO issued certificates are requested within the appropriate timeframes. All identified employees provided the necessary WEIM system access certificates.	TEP	Complete		Tariff section 29.2(b)(7)(E)(ii i)
18	System Readiness & Integration	ISO - prospective WEIM Entity interfaces	Data interfaces between prospective WEIM Entity's systems and CAISO systems are tested	ISO and prospective WEIM Entity identify significant data interface issues. WEIM Entity and CAISO executives to approve exceptions.	JOINT	Complete		Tariff section 29.2(b)(7)(E)(i)
19	Market Simulation	Day in the life simulation	The prospective WEIM Entity operators are able to meet the market timelines	The prospective WEIM Entity grid operations staff complete end-to-end daily market workflow with no critical defects.	JOINT	Complete		Tariff section 29.2(b)(7)(I)(ii)
20	Market Simulation	Structured scenarios simulation	The prospective WEIM Entity operators execute and pass all structured scenarios provided by CAISO	All significant issues resolved or have an interim solution that is functionally equivalent.	JOINT	Complete		Tariff section 29.2(b)(7)(I)(iii)
21	Market Simulation	Unstructured scenarios simulation	The prospective WEIM Entity operators execute and pass all unstructured scenarios provided by prospective WEIM Entity	All significant issues resolved or have an interim solution that is functionally equivalent.	JOINT	Complete		Tariff section 29.2(b)(7)(I)(iv)
22	Market Simulation	Market results reports	Market results are appropriate based on inputs	The prospective WEIM Entity and CAISO executive project sponsors approve the market results reports during market simulation	TEP	Complete		Tariff section 29.2(b)(7)(I)(v)
23a	Market Simulation	Market quality review	Prices are validated based on input data	Market simulation prices and MWs schedules/dispatches are validated by CAISO market quality team for entry into parallel operations	CAISO	Complete		Tariff section 29.2(b)(7)(I)(vi)
23b	Parallel Operations	Market quality review	Prices are validated based on input data	Parallel operations prices and MWs schedules/dispatches are validated by the CAISO market quality team	CAISO	Complete		Tariff section 29.2(b)(7)(I)(vi)
24	Market Simulation	The prospective WEIM Entity Identification	Validation of SCID's and Resource ID's	The CAISO has established and the prospective WEIM Entity has tested all necessary SCIDs and Resource IDs established for the prospective WEIM Entity's Balancing Authority Area	JOINT	Complete		Tariff section 29.2(b)(7)(I)(i)

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
25	Settlements	ISO Settlement Statements and Invoices published to the prospective WEIM Entity and WEIM Participating Resources	The CAISO Settlement statements and invoices match the operational data published to stakeholders or fed into settlement system and the resulting calculations correspond to the formulas defined in ISO's tariff and BPMs	Monthly settlement statement and invoice with corresponding daily statements produced during market simulation and parallel operations are verifiably accurate against available data.	JOINT	Complete		Tariff section 29.2(b)(7)(F)(i)
26	Settlements	The prospective WEIM Entity settlement statements and invoices reflect accurate allocations to the prospective WEIM Entity customers prior to financially binding operations.	Verification that settlement statements and invoices accurately reflects system and market data	The prospective WEIM Entity settlement statements and invoices that allocate charges and credits to its customers accurately reflect system and market data during parallel operations.	JOINT	Complete		Tariff section 29.2(b)(7)(F)(ii)
27	Monitoring	Data monitoring	Sufficient and adequate data is available to the CAISO and the Department of Market Monitoring	All required market monitoring data is available during testing and during post go-live for the key metrics (any exceptions will be addressed). CAISO will provide a market report that will provide publicly available information to all market participants.	CAISO	Complete		Tariff section 29.2(b)(7)(K)(v)
28	Parallel Operations Plan	Deployment plan	Parallel operations run consistently and in accordance with the timeframe set forth in the prospective WEIM Entity specific parallel operation plan	Parallel operations runs consistently within normal production CAISO Market disruption tolerances.	CAISO	Complete		Tariff section 29.2(b)(7)(J)
29	Outage Management System	Transmission and generation outage submittal and retrieval	The prospective WEIM Entity will verify its ability to submit and retrieve outage information with the CAISO	The prospective WEIM Entity validate their ability to submit and retrieve transmission out-of-service outages, generation Pmax derates, generation Pmin rerates, and generation out-of-service outage tickets within the required timelines.	JOINT	Complete		Tariff section 29.2(b)(7)(G)
30	Communications between the CAISO and the prospective WEIM Entity	Voice and/or electronic messaging	Implemented process and procedures used for voice and/or electronic messaging	The process and procedures are incorporated into the prospective WEIM Entities business processes before the start of market simulation.	TEP	Complete		Tariff section 29.2(b)(7)(H)(i)

Readiness Criterion Identifier	Readiness Category	Criteria	Measurable Elements	Threshold	Owner	Status	Evidence	Tariff Mapping
31	Communications between the CAISO and the prospective WEIM Entity	Communication tools	Staff are trained on communication procedures and tools	The prospective WEIM Entity operations staff who will have responsibility for WEIM operations, transactions and settlements are trained on the relevant operating procedures and tools used for WEIM related communications before the start of parallel operations	TEP	Complete		Tariff section 29.2(b)(7)(H)(ii)
32	Communications between the CAISO and the prospective WEIM Entity	3 <sup>rd</sup> party transmission service provider	The third party transmission service provider information that supports WEIM Transfers and Real-Time Dispatch included in the Full Network Model is available during parallel operations	The CAISO provides third party transmission service provider and path operator information to the prospective WEIM Entity through parallel operations	TEP	Complete		Tariff section 29.2(b)(7)(H)(ii)
33	WEIM Available Balancing Capacity	Identification of WEIM Available Balancing Capacity	Participating resources and non-participating resources for WEIM Available Balancing Capacity.	The prospective WEIM Entity has identified WEIM participating resources and non-participating resources that it intends to designate in the WEIM Resource Plan as WEIM Available Balancing Capacity	TEP	Complete		Tariff section 29.2(b)(7)(K)(ii)

**Attachment B – Affidavit of Khaled Abdul-Rahman**

**Informational Readiness Certification for**

**Tucson Electric Power’s**

**Participation in the Energy Imbalance Market**

**California Independent Systems Operator Corporation**

**April 1, 2022**



Affidavit of Khaled Abdul-Rahman Certifying Readiness of Tucson Electric Power (TEP)  
Implementation in the Energy Imbalance Market

I, Khaled Abdul-Rahman, Vice President of Power Systems and Market Technology for the California Independent System Operator Corporation (CAISO), hereby certify as follows:

1. As the Vice President of Power Systems and Market Technology, I am responsible for the systems and processes that support and enable the Energy Imbalance Market and, as such, I have responsibility for the implementation of TEP into that market.
2. I have reviewed the readiness dashboard and find that it is accurate and complete. All readiness criteria set forth in the CAISO's tariff and business practice manual have been satisfied or are expected to be satisfied as of TEP's May 3, 2022 implementation date.
3. Based on the readiness dashboard and other materials and my own review of relevant information and direct involvement with the readiness efforts, including testing, market simulation, training and parallel operations, and barring unforeseen developments, the systems and processes of the CAISO and TEP will be ready for TEP's implementation in the Energy Imbalance Market on May 3, 2022.
4. I will ensure that the CAISO maintains resource commitments necessary to sustain readiness through May 3, 2022 and address any unexpected conditions that may arise before May 3, 2022 that could undermine grid operation or market operation within the existing EIM Area or TEP's readiness. I will continue to monitor progress and resolve any unexpected conditions that may arise.
5. Actual implementation of TEP on May 3, 2022 is conditioned upon the lack of any unexpected and unresolved issues that could undermine grid operation or market operation within the existing EIM Area or TEP's readiness. I will update this certification in the event any unexpected issues are not resolved as of May 3, 2022.

I hereby declare under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge, information, and belief:

DocuSigned by:  
*Khaled Abdul-Rahman*  
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Khaled Abdul-Rahman, Vice President, Power Systems and  
Market Technology

March 31, 2022

**Attachment C – Affidavit of Erik Bakken**

**Informational Readiness Certification for**

**Tucson Electric Power’s**

**Participation in the Energy Imbalance Market**

**California Independent Systems Operator Corporation**

**April 1, 2022**

Affidavit of Erik Bakken Certifying Readiness of Tucson Electric Power (TEP) Implementation  
in the Energy Imbalance Market

I, Erik Bakken, Vice President of Systems Operations and Energy Resources for Tucson Electric Power Company (TEP), hereby certify as follows:

1. As the Vice President of Systems Operations and Energy Resources, I am responsible for the systems and processes that support and enable the Energy Imbalance Market and, as such, I have responsibility for the implementation of TEP into that market.
2. I have reviewed the readiness dashboard and find that it is accurate and complete. All readiness criteria set forth in the CAISO's tariff and business practice manual have been satisfied or are expected to be satisfied as of TEP's May 3, 2022 implementation date.
3. Based on the readiness dashboard and other materials and my own review of relevant information and direct involvement with the readiness efforts, including testing, market simulation, training and parallel operations, and barring unforeseen developments, the systems and processes of the CAISO and TEP will be ready for TEP's implementation in the Energy Imbalance Market on May 3, 2022.
4. I will ensure that TEP maintains resource commitments necessary to sustain readiness through May 3, 2022 and address any unexpected conditions that may arise before May 3, 2022 that could undermine grid operation or market operation within the existing EIM Area or TEP's readiness. I will continue to monitor progress and resolve any unexpected conditions that may arise.
5. Actual implementation of TEP on May 3, 2022 is conditioned upon the lack of any unexpected and unresolved issues that could undermine grid operation or market operation within the existing EIM Area or TEP's readiness. I will update this certification in the event any unexpected issues are not resolved as of May 3, 2022.

I hereby declare under penalty of perjury that the foregoing statements are true and correct to the best of my knowledge, information, and belief.

*Erik Bakken*

Erik Bakken (Mar 24, 2022 15:40 PDT)

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**Erik Bakken**, Vice President, System Operations and  
Energy Resources, Tucson Electric Power Company

Mar 24, 2022



**Attachment D – Parallel Operations Market Quality Report**

**Informational Readiness Certification for**

**Tucson Electric Power's**

**Participation in the Energy Imbalance Market**

**California Independent Systems Operator Corporation**

**April 1, 2022**

# **Market Validation of Parallel Operations for Tucson Electric Power (TEP) EIM Entity**

**March 25, 2022**

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## Executive Summary

Parallel operations activities of the Western Energy Imbalance Market (WEIM) started on February 16, 2022. This effort provides an opportunity to assess the readiness of Tucson Electric Power (TEP), the prospective Energy Imbalance Market (WEIM) Entity, to participate in the EIM. One of the readiness criteria requires the ISO to provide a market performance report for the period of parallel operations carried out for the integration of TEP into the real-time energy imbalance market. This report fulfills that requirement and summarizes the main findings of market validation carried out by the ISO with an emphasis on the WEIM results for the TEP.

The ISO validated both prices and schedules as part of the overall market performance based on input data that fed to the market systems parallel operations from February 16 through March 13, 2022. This validation demonstrates that the market solution produced is as expected and is consistent with the market rules as designed, recognizing that the input data may be influenced by limitations inherent in the parallel operating environment and these limitations may affect the quality of the solution. When factors affecting the input data are controlled for, the quality of the market solutions are as expected and indicate that the systems and processes of TEP are capable of operating in production.

## Background and Scope

The intent of parallel operations is to run the market to simulate as close as practically possible actual operating conditions of the system, and to provide TEP with an opportunity to go over specific day-to-day processes and activities required for the operation of the WEIM. This set-up provides TEP and the ISO with an opportunity to test their systems and procedures in advance of financially binding market operations.

Although closely resembling actual operations, parallel operations have some inherent limitations that need to be considered when evaluating market results, including the following:

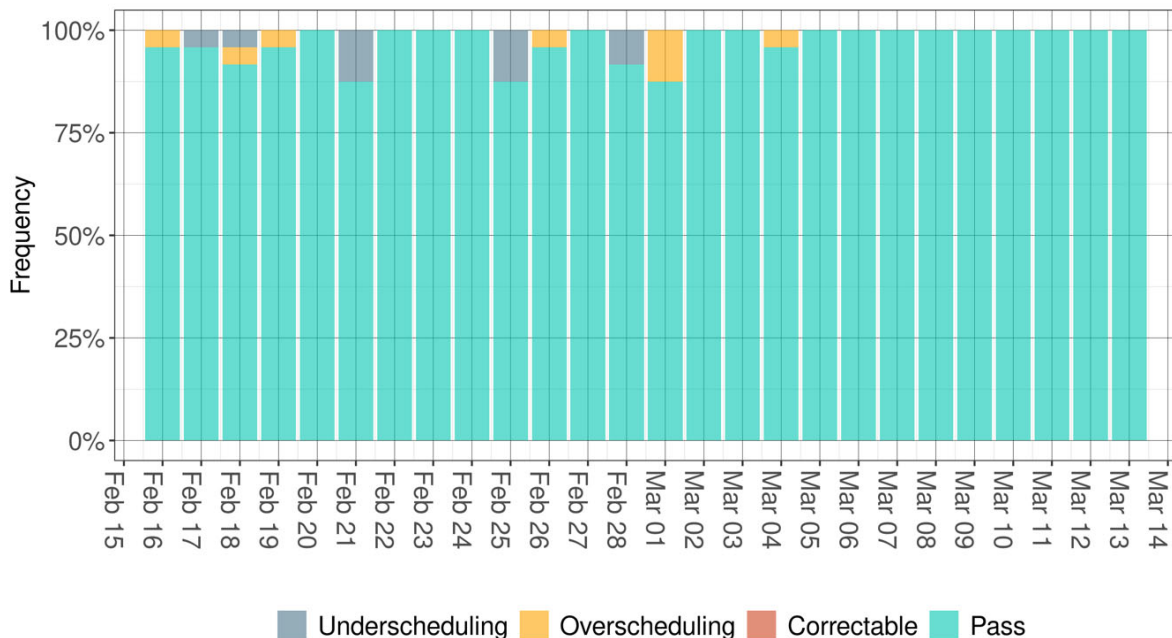
- i) The real-time market requires a set of data inputs to run. In actual real-time market operations, many of these inputs are dynamic, dependent on the participants' resources actual performance, and following instructions. For example, in an actual operating environment, telemetry received from resources gives the information to the ISO system of the operating status of the units, which are changing dynamically and interact with the market systems as the conditions change. During parallel operations, these iterative and interactive data processes are limited because the resources of the prospective EIM entity are not yet required to follow their five-minute dispatch instruction. Similarly, if telemetry from actual production is used, there may be a potential for mismatches between what the actual system is running with versus what the market is projecting due to units potentially not following market instructions. Therefore, the information regarding the resource's performance feedback to the market systems may or may not be related to the dispatch instruction issues through the parallel operations environment.
- ii) In actual operations, intertie resources require a closed loop for the market system to fully reflect the system and market conditions and intertie schedules eventually need to be tagged in order to reflect the system data flows. For parallel operations, it is not possible to replicate fully the actual tagging process, which may pose an additional challenge based on the data that is fed into the market system.
- iii) During parallel operations, the market participant is still defining its resources' data, including characteristics and bids, which consist of three-part bids used for generation resources that require careful consideration of start-up, minimum load and energy bid costs. During this period, the participant is also learning the impacts of the resources constraints on the actual operations of the market.
- iv) During the period of parallel operations, the prospective WEIM entities bids and base schedules are merged with the bids and base schedules from the current production systems to simulate the actual production environment. The process of combining information from two systems needs some time to synchronize the data flow across various applications.

These factors, among others, have an effect on the market results and the quality of the solution. Therefore, conclusions on the quality of the market results must consider the input data and the inherent set-up for parallel operations to avoid misleading conclusions about the actual functionality and robustness of the market. The Market Trends section provides metrics that capture TEP’s market performance during parallel operations; also, it includes various system issues that were identified during parallel operations and that affected market performance. The Market Validation items section provide a summary of issues identified during parallel operations.

## Market Trends

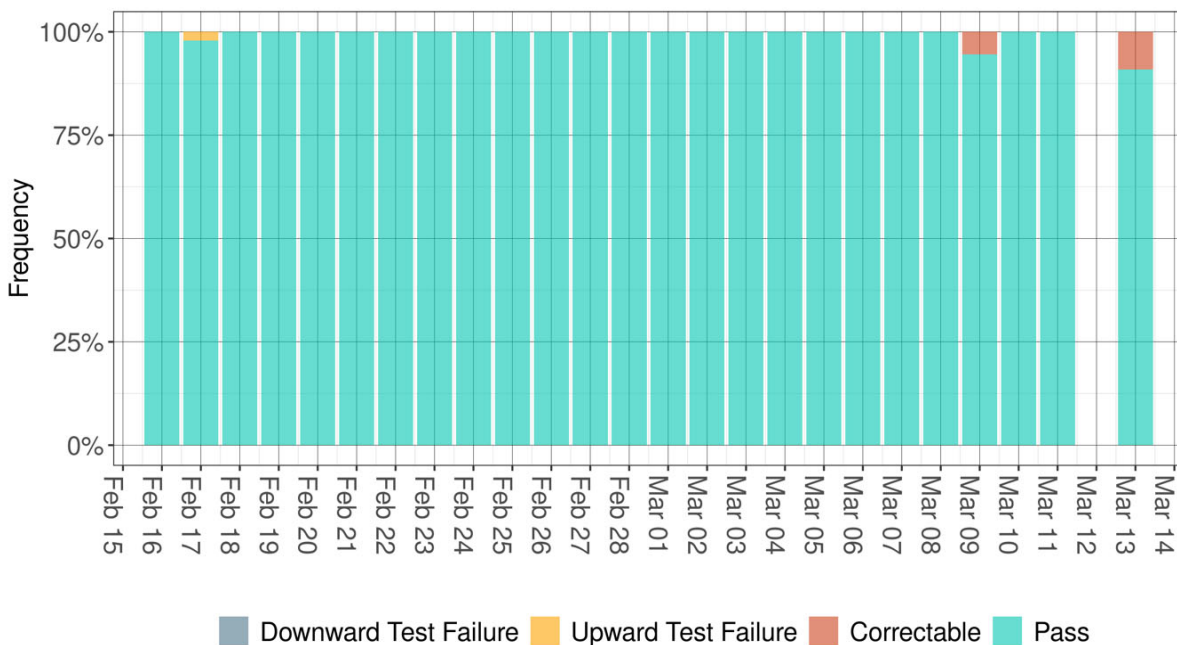
Figure 1 shows the TEP BAA’s performance for the balancing test as required under section 29.34(k) of the ISO tariff for the period of February 16, 2022 until March 13, 2022. The balancing test provides a reference of how well balanced (energy supply defined by the hourly base schedules meets the demand defined by the forecast respectively) the WEIM entity BAA is going to be into the real-time energy imbalance market. Having a large percentage of positive imbalance means the real-time market will be the last resort to balance the area incrementally. The incremental balancing of supply will come from the bid-in capacity made available in the market in addition to the base schedule or WEIM transfers between the participating WEIM entities’ BAAs. During the first 26 days of parallel operations, TEP passed the balancing test in 97.11 percent of hours. The Balancing failures that occurred were related to submission issues or operators learning to balance the system. TEP has passed the majority of the tests with less than 1 MW submission difference and has been diligent about identifying the issues that have caused failures.

**Figure 1: Daily frequency of power balancing test results**



A second test carried out before running the real-time market is the bid-range capacity test. Figure 2 shows the TEP BAA’s performance for the bid-range capacity test for February 16 through March 13, 2022. From March 9 to 13, 2022, in the parallel operations environment, the ISO was streaming two sets of telemetry data for resource dispatch and this caused large oscillations in dispatch. On March 12, 2022, the tool that sends flexible ramp requirements and load forecasts to the Real-Time Market application had a failure so there the parameters to complete the tests were not available for this day. On March 13, 2022, the ISO did not send the load forecast to the parallel operations environment for the first seven hours of the trade date. In Figure 2, any failed tests affected by this issue are represented as correctable events because it was a result of ISO automation process failure. With the correctable events removed from the count of failures TEP passed 100 percent of the tests over parallel operations period.

**Figure 2: Daily frequency of bid range capacity test results**



A third test carried out before running the real-time market is the flexible ramp sufficiency test, as required by section 29.34 (m) of the ISO tariff. The flexible ramp sufficiency test evaluates whether the WEIM entity has sufficient flexible ramp capacity to meet both its upward and downward ramp requirements based on optimized resource schedules before the trading hour. From February 16 through March 13, 2022, TEP passed the flexible ramp up tests in 99.92 percent of the hours and passed the flex ramp down test in 100 percent of the hours. The same system issues that affected the bid-range capacity tests also affected TEP’s flex ramp sufficiency tests on March 9, March 12 and March 13. These are represented as correctable events in Figure 3.

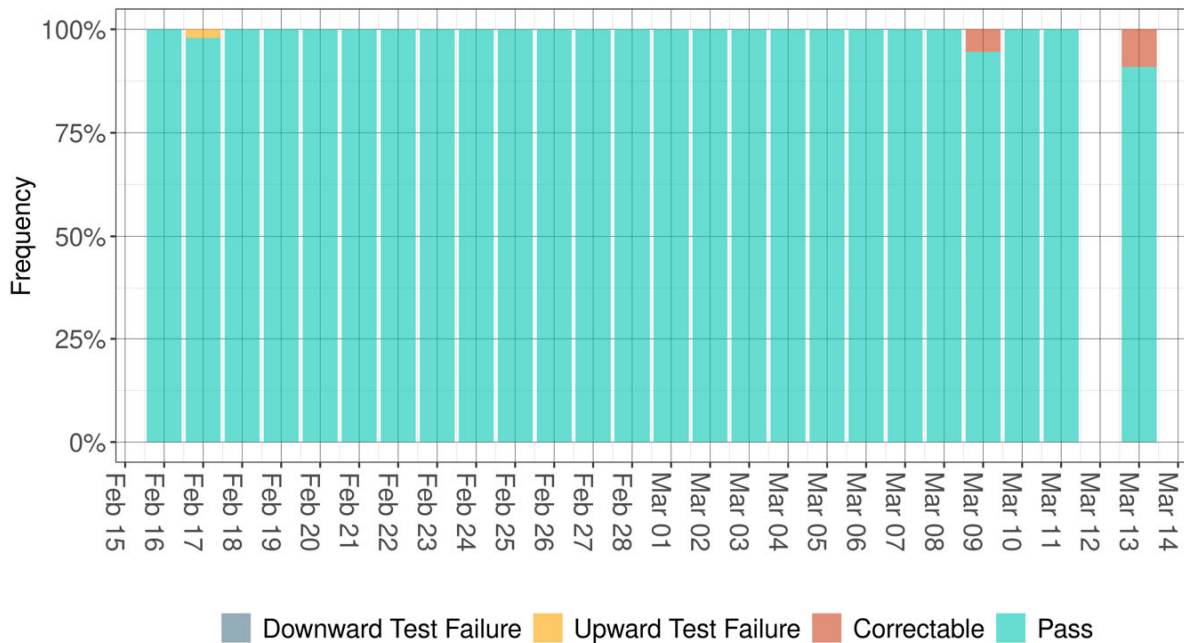
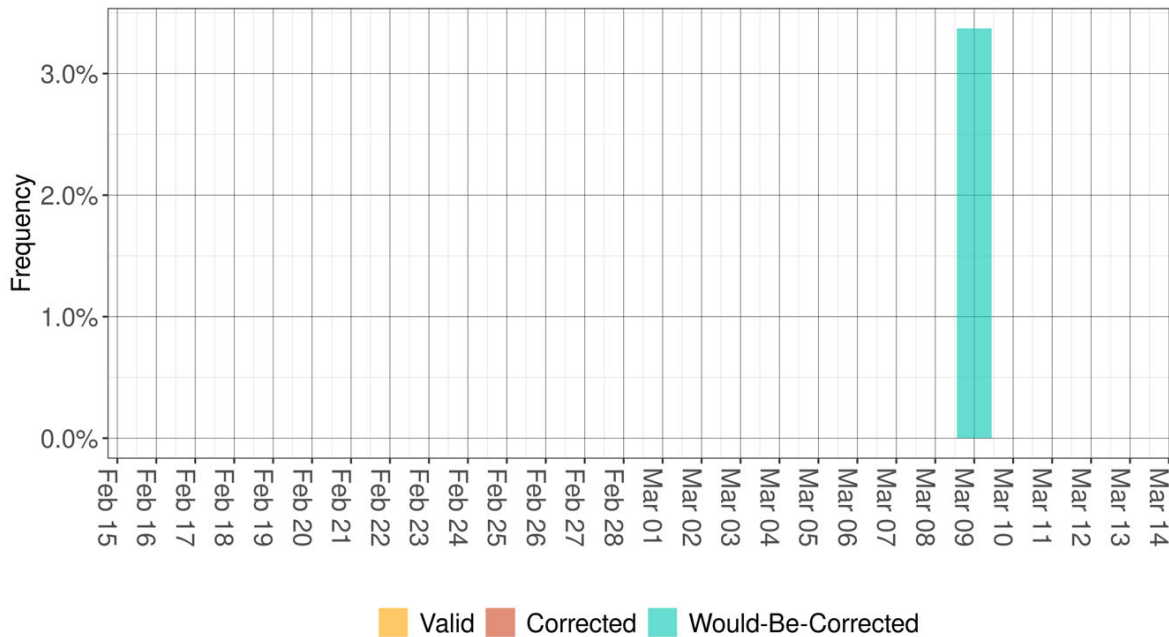
**Figure 3: Daily frequency of flexible ramp test results**


Figure 4 and 5 shows the frequency of power balance constraint infeasibilities for under-generation conditions in both the Fifteen Minute Market (FMM) and real-time dispatch (RTD) markets. The power balance constraint infeasibilities are pegged to the corresponding penalty prices, of \$1000/MWh (or \$2000 for certain conditions under implementation of FERC order 831) for under-supply infeasibilities, and about -\$150/MWh for over-supply infeasibilities. However, during parallel operations, the EIM market for TEP has been set-up to run under the conditions reflecting the price discovery mechanism that is in effect under the transitional period (the first six months in an actual production system). Under this functionality, when its power balance constraint is infeasible, the market will reflect the last economic signal instead of the penalty prices. The first six months transitional period pricing is based on the FERC Order<sup>1</sup>, which grants the prospective EIM entity the time to re-adjust and fine-tune its systems, processes, and procedures to avoid conditions that trigger administrative penalty prices due to false under-supply or over-supply conditions. The transition period pricing also shields the prospective EIM entity from getting administrative penalty prices during the first six months. This period allows the entity to gain production experience in dealing with timely response to inform the market about operators’ manual actions that are taken or decided outside the market to maintain the EIM entity BAA reliability or balancing needs such as deployment of operating reserve in response to forced outages.

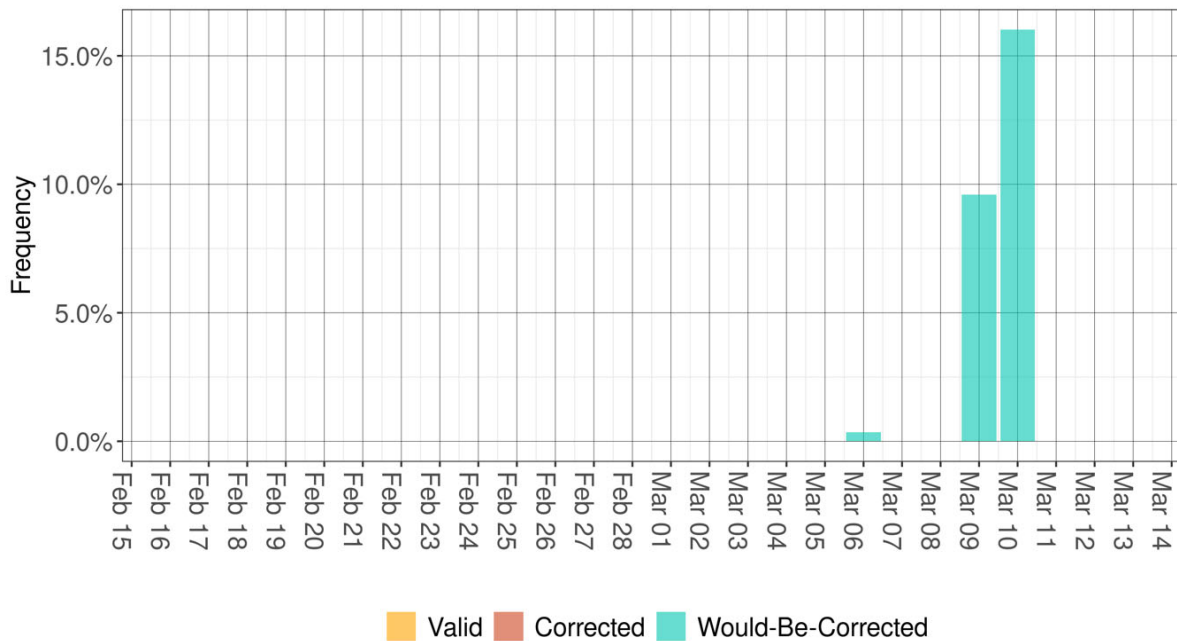
<sup>1</sup> *Calif. Ind. System Op.*, 153 FERC ¶ 61,104 (2015).



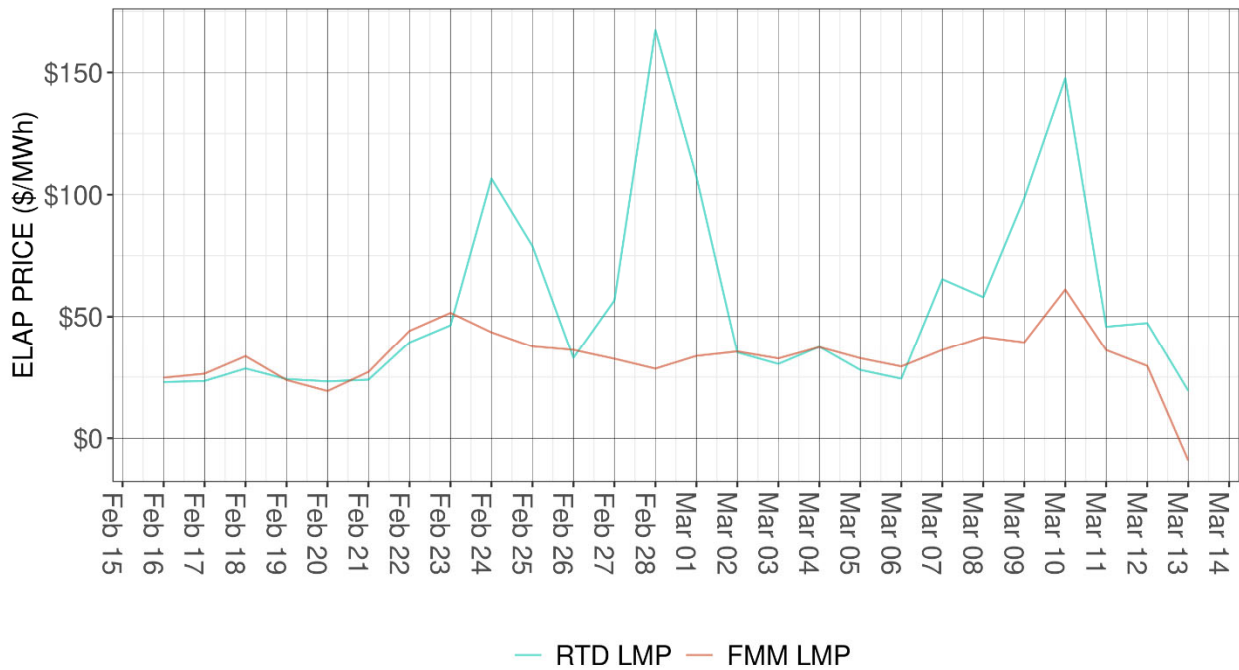
**Figure 4: Daily frequency of supply infeasibilities in the fifteen-minute market**


From February 16 through March 13, 2022 for the FMM, TEP had three intervals with under-supply power balance infeasibilities; however, all of these infeasibilities would be corrected because the ISO had an issue streaming the correct telemetry for resource output from March 9 to March 13.

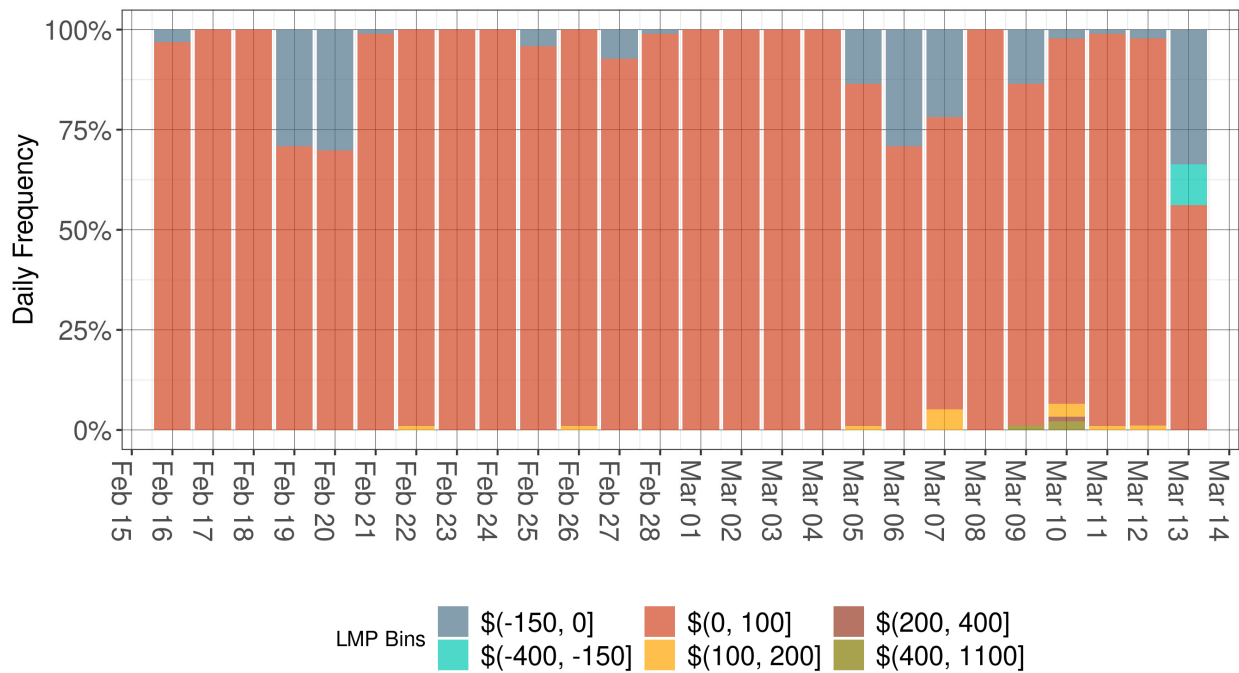
For the five-minute market, TEP had 72 intervals with under-supply power balance infeasibilities, however, all of these infeasibilities would be corrected for the ISO telemetry streaming issue.

**Figure 5: Daily frequency of supply infeasibilities in the five-minute market**


The Figure 6 shows the daily average ELAP locational marginal prices (LMPs) for the fifteen-minute market and the five-minute market. The average daily prices from February 16 through March 13, 2022 in the fifteen-minute market were between  $-\$9.09/\text{MWh}$  and  $\$61.13/\text{MWh}$ . The average five-minute prices were between  $\$19.40/\text{MWh}$  and  $\$167.36/\text{MWh}$ .

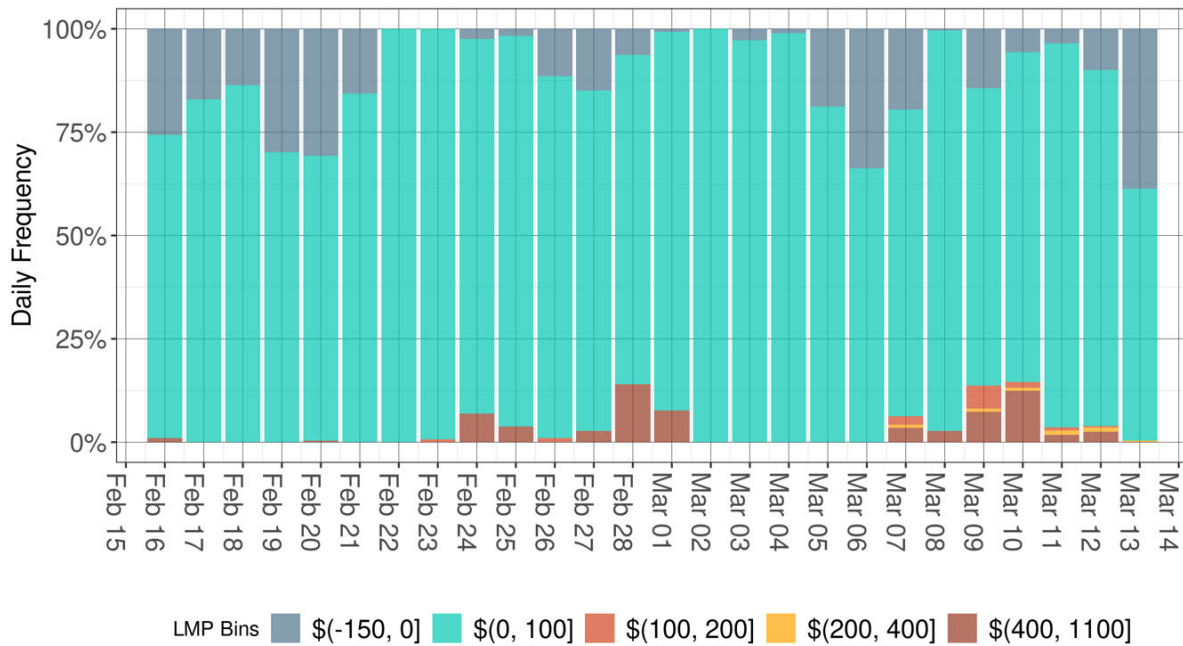
**Figure 6: Daily average of fifteen-minute market and five-minute market prices**


Figures 7 and 8 show the FMM and RTD ELAP prices for the TEP BAA classified by price bins.

**Figure 7: Daily frequency of fifteen-minute prices organized by price ranges**


For all trade dates from February 16 through March 13, 2022 about 91.6 percent of the FMM intervals observed prices were between \$0/MWh and \$100/MWh. At the same time, 84.6 percent of the five-minute prices were between \$0/MWh and \$100/MWh.

**Figure 8: Daily frequency of five-minute prices organized by price ranges**



## Market Validation Items

1. **Parallel Operation Telemetry Streaming Issue**  
From March 9 to March 13, 2022 the ISO was streaming in both production telemetry and Stage simulation telemetry data when it should have only been production telemetry data. This caused large oscillations in resource output and as a result large oscillations in resource dispatch. The ISO corrected this to stream only production data.
2. **Aligning EIM transfer limits in Stage environment.**  
There were issues with locked ETSRs and ETSR limit values in the Stage parallel operations environment that were not present in the production environment which lead to transfers being limited in some areas. The locked ETSRs were fixed on March 17.
3. **On March 12, 2022, the tool that sends flexible ramp requirements and load forecasts to the Real-Time Market application had a failure so the parameters to complete the tests were not available for this day. The ISO did not have an alert for this issue. The ISO is working on additional alerts for the Stage parallel operations environment.**
4. **On March 13, 2022, the ISO's system did not send the load forecast to the parallel operations environment for the first seven hours of the trade date and did not have an alert for this issue. The ISO is working on additional alerts for the Stage parallel operations environment.**
5. **Load forecast**  
ISO and TEP continue to work on improving the load forecasting that is being used in the market. ISO continues to work on improving the model for behind-the-meter solar output that impacts TEP's load forecast in the mid-day and through the evening peak hours.

## Conclusion

The ISO validated both prices and schedules based on input data fed through the market systems parallel operations from February 16 through March 13, 2022. This validation demonstrates that the market solution was produced as expected and is consistent with the market rules as designed, recognizing that the input data may be influenced by limitations inherent in the parallel operating environment and these limitations may affect the quality of the solution. When factors affecting the input data are fixed or controlled for, the quality of the market solutions are as expected and indicate that the systems and processes of TEP are capable of operating in production.

## CERTIFICATE OF SERVICE

I hereby certify that I have served the foregoing document upon the parties listed on the official service list in the captioned proceedings, in accordance with the requirements of Rule 2010 of the Commission's Rules of Practice and Procedure (18 C.F.R. § 385.2010).

Dated at Folsom, CA this 1st day of April, 2022.

*1st Jacqueline Meredith*

Jacqueline Meredith  
California ISO  
250 Outcropping Way  
Folsom, CA 95630